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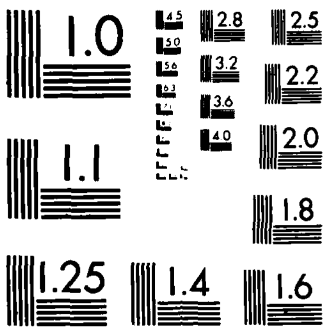

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THE BATTLEFIELD OF THE 1990s

by

G.R. Lindsey

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G.R. LINDSEY

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ABSTRACT

While the new weapons likely to appear on the battlefields of the 1990s will add formidable capabilities, some will be offset by direct countermeasures and others by the effects of properly integrated combined arms tactics. There will be important improvements to ground-based air defence weapons, to air-to-ground weapons, to anti-tank guided missiles, to land mines, and to anti-personnel weapons. Dominant features of the 1990s will be electronic warfare, fast movement, and the rapid expenditure of ammunition.

RESUME

Bien que les nouvelles armes qui se présenteront sur les champs de bataille des années quatre vingt dix feront preuve de capacités accrues, quelques-unes d'entre elles se trouveront annulées par des contre-mesures directes, et d'autres par les effets bien intégrés des tactiques inter-armes. On s'attend à ce qu'elles soient perfectionnées, les armes terrestres de défense contre avions, les armes air-sol, les engins guidés anti-chars, les mines-terrestres et les armes anti-personnel. Les grands trai' · des années quatre vingt dix seront la guerre électronique, le mouvement vite et la consommation rapide des munitions de guerre.

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THE BATTLEFIELD OF THE 1990s

1. CONFLICT IN THE 1990s

1.1 Some Working Assumptions

In order to discuss "The Battlefield of the 1990s" it is necessary to make some assumptions about what will happen during the 1980s, and to decide whether or not to assume that nuclear weapons will be employed on the battlefield of the 1990s.

Mutual nuclear deterrence has prevented the outbreak of World War III to the end of 1982, and promises to remain mutual and reasonably stable through the rest of the 1980s. Let us assume that it is preserved into the 1990s, but that during the 1990s international conflict reaches the stage at which large forces of well-trained ground troops, supported by tactical air forces, and equipped with the latest weapons of the day, engage in operations of war. Assume furthermore that, although the threat of nuclear weapons is present, they are not in fact exploded, either on the battlefield or against population.

1.2 The Battlefield

The word "battlefield" suggests well-organized operations between clearly identifiable forces in close contact, in an area allowing for manoeuvre. There are, of course, many other types of situation in which military conflict can occur, such as guerilla warfare, counter insurgency operations, or forcible imposition of economic blockade. And the freedom to manoeuvre in battle could be restricted by the presence of built-up areas. However, these situations will not be considered in this paper. Neither will the maritime dimension of conflict - we will confine the discussion to the land/air battle.

2. PROBABLE DEVELOPMENTS TO BATTLEFIELD WEAPONS BY THE 1990s

2.1 Changes Unlikely to be Important before the Year 2000

To have an important effect on the battlefield, new weapons must have been completely researched, developed, tested, and evaluated; gone into mass production, been accepted in quantity by the armed forces, and been deployed to the operational formations. In addition, doctrine and tactics to exploit their new characteristics must have been evolved, and it may have been necessary to modify force structures. Finally, the troops must have been trained to use the new weapons. This sequence of events takes a number of years, especially in peace time. Consequently, weapons and equipment still in the earliest stages of the sequence at the end of 1982 may not have much influence on a battle occurring in 1990, although they could before 1999.

One encounters forecasts of laser or death ray weapons likely to revolutionize military combat. There is no doubt that great advances are being made in laser technology. Already there are very useful applications of lasers in the roles of range-finding and of target designation. These use very little power, and are instruments rather than weapons. We can expect further developments before long for such purposes as surveillance and communication. However, to become a weapon of destruction it will be necessary to deliver large amounts of energy to the target. Not very much energy would need to be delivered to injure an unprotected man, considerably more to damage an aircraft or thin-skinned ground vehicle, and more still to damage a tank. The equipment needed to generate the necessary power and convert it into a laser beam may prove to be bulky and immobile, and it is doubtful that many practical laser weapons will be deployed on the battlefield in the 1990s.

Great progress has been achieved in the use of orbiting satellites to observe activities from space. Further improvements are to be expected before the end of the century, especially in the detection and tracking of aircraft in flight. Such capabilities will be increasingly important for intelligence gathering and strategic warning. It is not, however, certain that the data handling capacities or the ability to detect with high resolution under conditions of poor visibility will enable space detection systems to play an important part in the tactical conduct of land battles in the 1990s.

2.2 Cruise Missiles

Although cruise missiles date back to World War II, and have been developed by the USSR for naval use through the 1960s and 1970s, recent spectacular advances in the technologies of guidance and of propulsion offer many new applications. Once a cruise missile has been developed, it is a comparatively easy matter to arrange for its launching from a ground vehicle, an aircraft, a surface ship, or a submarine. The mode of guidance best adapted for accurate navigation over land is by terrain comparison radar. This requires the accumulation of precise digitized contour maps of the territory over which the missile will fly, right to the area of the final target. The best way to construct such maps is by special radar satellites, at present only possessed by the USA and USSR.

The most newsworthy applications of cruise missiles today are to carry nuclear weapons to strategic targets and to strike surface ships at very long ranges. However, their technical capabilities and comparatively low costs are such that they may acquire roles on the battlefield of the 1990s, armed with conventional warheads and quite possibly replacing aircraft for some functions, and extending the range of air-delivered weapons for some other functions.

Cruise missiles are likely to fly at very low altitudes at subsonic speeds, or at high altitudes at hypersonic speeds. They tend to be smaller than aircraft, and so present more difficult targets to radar. Defence against the cruise missile is not impossible, especially on a battlefield already well-equipped with antiaircraft weapons.

2.3 Ground-Based Air Defences

Although antiaircraft guns could fire shells that moved much faster than their targets, the difficulty of predicting the motion of the target between the time of fixing and the time of the (intended) hitting of the aircraft by the shell was such that AA fire against an evading target was notoriously wasteful, especially when the target flew at high altitude. The answer to this deficiency was the Surface-to-Air guided missile, able to alter its flight path in order to conform to the motion of the target. A missile can be made more manoeuvrable than an aircraft, and can be made to home on radar or heat signals from the aircraft.

By the 1960s and 1970s Surface-to-Air Missiles had got the measure of aircraft flying at high or medium altitudes. An example was the destruction of the American high altitude U2 reconnaissance aircraft by a Soviet SA-2 missile over Sverdlosk in 1960.

Because the larger Surface-to-Air Missiles systems require some time for the radar fire control to acquire the target and lock on, and for the missile to accelerate, they are at a disadvantage against targets moving fast at low altitudes. However, it is against this type of target that multiple AA guns have a better chance, especially if controlled by radar and if they have a high rate of fire. Also, against helicopter targets, which generally fly rather slowly and at low altitudes, AA guns and the smaller shoulder-fired heat-seeking SAMs can be deadly.

As a result of the increasing effectiveness of ground-based air defence, aircraft will not be able to operate above the battlefield of the 1990s until they have succeeded in suppressing the defences. The two main methods of accomplishing this are by electronic countermeasures against the fire control systems, by timed manoeuvre, and by physical attack, whether from the air or the ground, of the missile sites and control installations.

2.4 Aircraft

For the first seventy years after the first flight, the designers of military aircraft engaged in a race for greater aerodynamic performance (i.e. speed, altitude, and range). Today this race has virtually ended, with the military value of an aircraft more dependent on its armament and its avionics than on the vehicle itself.

Several good basic air frames, such as those of the A3, F4, and Mig-23, have been adapted for various roles, and with external pods it is possible to equip one aircraft to perform different tasks.

Because of the increasing effectiveness of ground-based anti-aircraft defences, we have seen the emergence of the A10, a slow, armoured aircraft carrying a heavy load of air-to-surface weapons for close support of ground troops. Beyond this, Remotely Piloted Vehicles are appearing and may replace unarmed aircraft for some of the most dangerous roles.

Large air bases and aircraft on the ground are now so vulnerable to attack by air or by missile that great advantages are obtained by the use of Vertical and Short Takeoff and Landing Aircraft. These can be widely dispersed, away from airfields, and can operate from short strips or even from highways.

The operation of fighter aircraft which wish to intercept enemy bombers, and of friendly attack aircraft which wish to avoid enemy interceptors, will be greatly aided by Airborne Warning and Control (AWACS), which can oversee the enemy side of the Forward Line of Troops, track targets at all altitudes, identify hostile aircraft, and direct engagements by friendly aircraft and ground defences.

There will be increasing dependence on helicopters for a multitude of applications, including attack as well as transport, but it must be recognized that they are extremely vulnerable to ground fire.

2.5 Aircraft Armament

Very important improvements are being made to airborne radar, including Sideways Looking Radar (SLAR) which can map features on the ground with high resolution, and Airborne Moving Target Indication (AMTI) which can detect and track aircraft flying at very low altitude.

Airborne weapons are getting "smarter" all the time, so that it is no longer necessary to assign a large number of aircraft to a single target in order to overcome limitations in the accuracy of weapon delivery. It might be necessary in order to ensure that one or two aircraft manage to penetrate strong AA defences.

The principle on which some of the most successful "smart weapons" operate is homing on a "spot" marked by a laser designator beam. This beam can be aimed by a forward observer on the ground, by one of the aircrew in the launching aircraft or in another aircraft, or possibly by an unmanned vehicle under remote control.

Munitions are being specially designed for the attack of airfields, to crater runways and to create hazards to personnel attempting to repair the damage.

Recently developed missiles now make air-to-air engagements possible at very long range, provided that the aircraft is equipped with a powerful radar. However, identification is uncertain until visual contact has been achieved, and at shorter ranges the advantac may be with manoeuvrability and cannons rather than with sophisticat missiles.

Air-to-air missiles can home on radar or on heat signals, but both are subject to countermeasures. Homing can be difficult against targets flying at very low altitudes.

2.6 Anti-Tank Guided Missiles

During the 1970s, the first generation of anti-tank guided missiles using "Manual Command to Line-of-Sight" guidance reached a high state of perfection. These required the operator to steer the missile all the way to the target, usually by instructions transmitted through a pair of trailing wires. At the longer ranges the time of flight was quite long, and if the operator was subjected to counter-fire he might not be able to complete the rather exacting task of tracking both missile and target throughout the full trajectory.

In the 1980s, we are seeing a second generation of ATGMs, using "Semi-Automatic Command to Line-of-Sight", for which the operator has only to follow the target, with the missile tracking along his guidance beam.

By the 1990s, there will be a third generation, "Automatic Command to LOS", which will still require the operator to acquire and designate the target and launch the missile, but subsequent homing will be fully automatic.

Anti-Tank Guided Missiles can be rocket-propelled from the ground, from a land vehicle, from a Fixed Wing Aircraft, or from a helicopter, and probably in the future from a Remotely Piloted Vehicle. Or they can take the form of shells fired by artillery and steered aerodynamically during the latter part of their trajectory. They can be guided to home on a spot positioned by a laser designator, directed by an observer on the ground, in a vehicle, in a Fixed Wing Aircraft or a helicopter.

By the 1990s, it may be possible to launch special sub-munitions from guns, rockets, or aircraft which are able to seek and find tanks or other vehicles using millimetre-wave radar, infrared, or optical means, attacking them from above or the side rather than through their thick frontal armour.

In general, guided missiles will not possess great kinetic energy, and will need to use the kill mechanism of a shaped charge or a squash head bursting on impact with the tank if they are to hole thick armour or to drive fragments into the interior. Against this type of attack there are new types of armour, using spaced layers of composite materials.

The other kill mechanism against tanks is to employ great kinetic energy, using a long heavy solid Armour Piercing round hitting the armour at very high velocity. This requires a gun, whether in a tank, in a tank destroyer, or on its own wheels, and has a shorter time of flight than a rocket. At short range it will not be necessary to compensate for the motion of the target, and accuracy will be good. At longer ranges, where target motion does matter, accurate fire control will require measurement of range and computation of deflection, and air resistance will rob the round of some of its kinetic energy.

Thus, it can be concluded that guns will be more effective than guided missiles for the frontal attack of well-armoured tanks at short range. But at longer ranges, and when attack from above is possible, ATGMs will be more effective than guns. By use of natural cover and smoke, attacking tanks (equipped with guns rather than missiles) may make engagement at the longer ranges very difficult.

2.7 Land Mines

Land mines can be formidable obstacles to the movement of tanks, other vehicles, and personnel on foot. They are being made more effective than ever before in three ways.

The earlier land mines were buried, and were triggered by the physical presence of a vehicle track or wheel, or a human foot. Obviously the target had to pass directly above the mine. Now it is possible to use remote sensing devices to trigger the mine, and to have it increase its effective range by jumping several feet in the air before exploding.

The ability of detectors to locate buried mines has depended on the presence of metal. It is now possible to construct mines out of plastic material which will not activate the detectors.

When defensive positions are prepared before the enemy is close, it is practical to bury mines by hand, or with the aid of special digging machines. However, the ability to emplace a minefield quickly in the middle of mobile operations can create an unexpected obstacle to enemy advance and exploitation of success. This is now becoming possible, with dispersal being effected by aircraft, rockets, or guns. The mines would not be buried, but if scattered on ground covered by vegetation they would be hard to spot, especially from vehicles.

While mines can be swept, by hand, by special vehicles, and by explosive devices, the process is slow and dangerous. Unless the attackers accept considerable delays they are likely to suffer casualties from remotely delivered minefields.

2.8 Improved Anti-Personnel Weapons

Small arms are becoming lighter, firing smaller calibre bullets with very high velocity and a high rate of fire. Although these weapons do not have the range of the older types, they have great wounding power at short range. Experience in past wars has shown that there is very little aimed fire by small arms at the longer ranges, so that it is more efficient to provide most of the riflemen with weapons optimized for effectiveness at short range.

Larger munitions launched from aircraft, guns, and helicopters will contain sub-munitions capable of lethal wide area dispersal. This will cause the effects to be more uniformly distributed, instead of having an "overkill" in a small area.

Self-actuated and delayed-action devices will add psychological and nuisance factors to the casualties inflicted.

3. DOMINANT ASPECTS OF THE BATTLEFIELD OF THE 1990s

3.1 The Importance of Combined Arms Tactics

Some of the new weapons just described are likely to be so effective against their intended targets as to neutralize them completely, unless countermeasures are taken. In many cases the most effective countermeasures will make use of systems other than those targeted by the new weapons. In other words, the appropriate reaction will be to use combined arms, exploiting the strengths of each to compensate for the weaknesses of the others.

An example of the need for combined arms tactics was offered by the success of Egyptian ATGMs against Israeli tanks in 1973, when the latter operated without artillery, infantry, or air support. In the same war, when the Israeli air force attempted to operate above Egyptian ground forces equipped with effective SAM and AA batteries, they suffered heavy losses until they devoted the efforts of both air and ground forces to the suppression of those AA defences.

On the battlefield of the 1990s, attacking armour must advance with the coordinated support of artillery, infantry, and air, which can exploit the vulnerability of ATGM crews, especially during the flight of their missiles. In addition the tanks will need the support of mobile AA defences to counter the antiarmour capabilities of enemy aircraft, both fixed wing and rotary wing. Conversely, considering the problems of defenders against armoured attack, their ATGM crews will need the support of infantry, artillery, and close support aircraft, and their close support aircraft will need to have the enemy air defence weapons suppressed, whether by air weapons, ground-delivered weapons, or electronic warfare.

3.2 Electronic Warfare

Much of the technology which provides for the effectiveness of the new systems is based on electronics, especially on the electromagnetic transmissions of radar, of guidance signals, and of communications. Electromagnetic transmissions are subject to countermeasures, against which there are counter-countermeasures. It is a highly technical contest, in which success is very dependent on detailed knowledge of the opponent's equipment and up-to-the-minute tactics. Rapid changes in the situation are to be expected, as responses are made on both sides.

Against radar, we can expect jamming and chaff. Against radio frequency guidance signals there will be alerting devices to warn the intended victim, and jamming and deceptive transmissions to foil the guidance. Against laser, infrared, and optical signals we will see smoke, deceptive flares, camouflage, and the use of whatever concealment may be offered by nature. We must expect jamming to be used against our radio communications. With all of these transmissions we can expect detectors and direction-finders to be used to locate the source for subsequent attack, or even for instant attack by missiles homing on the transmitter.

Instead of interfering with wireless communications, the enemy may prefer to monitor them and obtain valuable intelligence. However, counter-countermeasures are available to make the communications secure.

Because of the threat from antiaircraft missiles, all tactical aircraft will need some self-protection EW equipment. Beyond this, there will be a growing need for specialized aircraft to provide EW support for other aircraft attacking over heavily defended areas.

The proper response to received electromagnetic signals may be to radiate a particular jamming transmission, undertake an evasive manoeuvre, or to launch an appropriate weapon. In order to react quickly, making full use of known information, there will be increasing dependence on computer decisions, based on stored intelligence data and a prearranged program. In many of the latest tactical aircraft it has been judged that computers are faster and better able than a second crew member to cope with simultaneous requirements.

3.3 Rapid Movement, Rapid Expenditure of Ammunition

The use of mobile AA weapons to move with the armour should enable an air defence umbrella to be kept above the advancing spear-heads. The newer Infantry Combat Vehicles will provide increased mobility and firepower to the infantry, including an element of organic antitank and AA armament. Night vision equipment should allow operations to continue twenty-four hours a day.

The concentrated hitting power of the new weapons, combined with high mobility of modern ground forces offers great possibilities for the attacking force to achieve a breakthrough followed by deep and broad exploitation. However, the improved capability for the defender to put obstacles into place quickly, and to cover them with powerful weapons may enable him to seal off a breakthrough, and the same potential for firepower and mobility which helped the initial attack could help the counterattack.

The new weapons will inflict casualties to men and equipment at unprecedented rates, so that the outcome could depend on the rate of reinforcement. Ammunition will be expended at a prodigious rate. Since they are very expensive, weapon stocks are unlikely to be large, and those stationed forward will probably be used up very quickly. The outcome of the battle could depend on which side first ran out of new weapons.

3.4 Significance for Deterrence

Whereas new weapons deployed by one side can probably be countered if the opponent provides himself with the appropriate offsetting weapons and tactics, it will be necessary to have these available in sufficient numbers, and to have the commanders and troops properly trained in their employment.

If the Warsaw Pact equips and trains their forces for the battlefield of the 1990s, but NATO remains with the weapons and tactics of the 1980s, it is most improbable that a conventional attack from the East could be contained for long by conventional means. Deterrence would come to depend on tactical nuclear weapons even more than it does today, and the nuclear threshold would be lowered, a development that would appear unwelcome to almost everybody.

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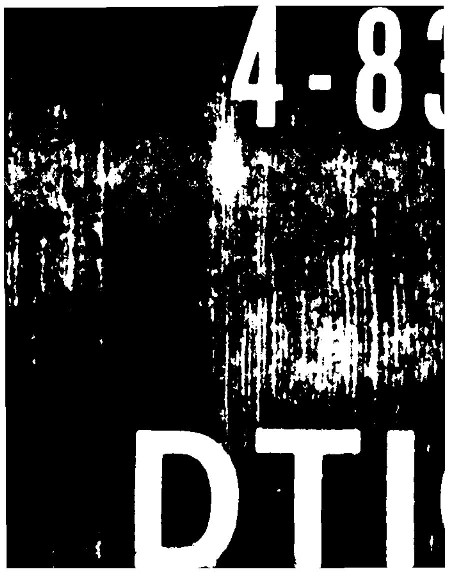
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